

# IBM® zEnterprise™ System

## Network Architecture and Virtualization Overview

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## Agenda



- ❑ **IBM® zEnterprise™ System Overview**
  
- ❑ **IBM® zEnterprise™ System Network Virtualization and Management Overview**
  - zEnterprise Node Physical Infrastructure
  - Communications within the Ensemble
  - Network and OSA Types and Attributes
  - External Network Access
  - Network Virtualization Management
  - Provisioning Virtual Networks
  - Network Access Control and Security



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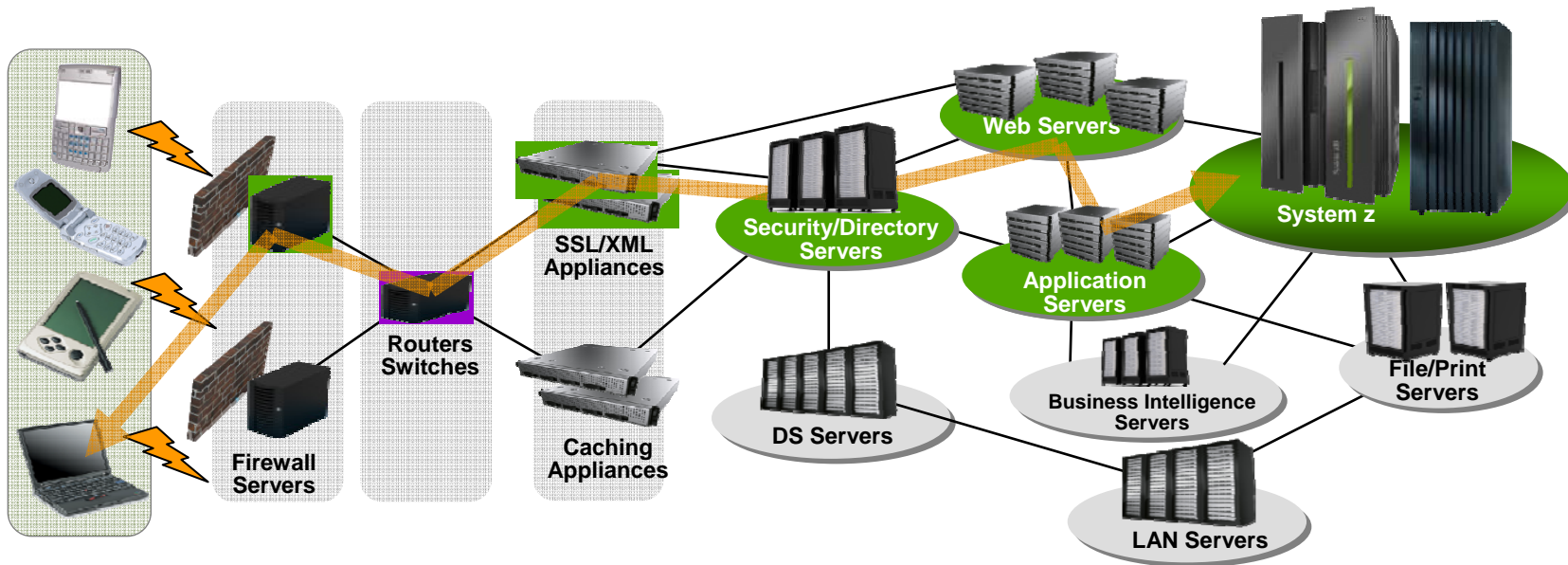
# IBM® zEnterprise™ System

## System Overview



## Information Technology Today: Limitations

***Information technology today is limited by the technology and architecture configurations available.***



- Business processes and the applications that support them are becoming more service oriented, modular in their construction, and integrated.
- The components of these services are implemented on a variety of architectures and hosted on heterogeneous IT infrastructures.
- Approaches to managing these infrastructures along the lines of platform architecture boundaries cannot optimize: alignment of IT with business objectives; responsiveness to change; resource utilization; business resiliency; or overall cost of ownership.
- **Customers need better approach: The ability to manage the IT infrastructure and Business Application as an integrated whole.**

# IBM zEnterprise System – Best in Class Systems and Software Technologies

*A system of systems that unifies IT for predictable service delivery*



## Unified management for a smarter system: **zEnterprise Unified Resource Manager**

- Unifies management of resources, extending IBM System z® qualities of service end-to-end across workloads
- Provides platform, hardware and workload management

The world's fastest and most scalable system:  
**IBM zEnterprise™ 196 (z196)**

- Ideal for large scale data and transaction serving and mission critical applications
- Most efficient platform for Large-scale Linux® consolidation
- Leveraging a large portfolio of z/OS® and Linux on System z applications
- Capable of massive scale up, over 50 Billion Instructions per Second (BIPS)



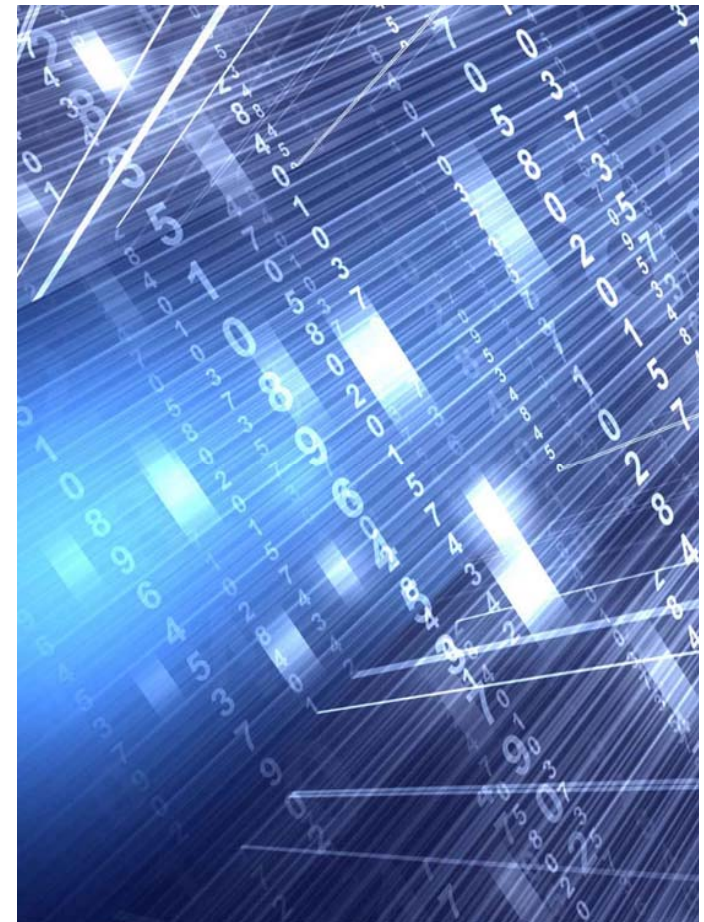
Scale out to a trillion instructions per second:  
**IBM zEnterprise BladeCenter® Extension (zBX)**

- Selected IBM POWER7® blades and IBM System x® Blades<sup>1</sup> for tens of thousands of AIX® and Linux applications
- High performance optimizers and appliances to accelerate time to insight and reduce cost
- Dedicated high performance private network

<sup>1</sup> All statements regarding IBM future direction and intent are subject to change or withdrawal without notice, and represents goals and objectives only.

## Operating System Support for zEnterprise System

- **Currency is key to operating system support and exploitation of future servers**
- **The following are the minimum operating systems planned to run on z196:**
  - z/OS
    - z196: z/OS V1.9<sup>1</sup> for toleration only; exploitation starts with z/OS V1.10 with full exploitation with z/OS V1.12
    - Ensemble support: z/OS V1.10
  - Linux on System z distributions:
    - Novell SUSE SLES 10 and SLES 11
    - Red Hat RHEL 5
  - z/VM
    - z196: z/VM V5.4 or higher
    - Ensemble support: z/VM V6.1
  - z/VSE V4.1 or higher
  - z/TPF V1.1 or higher
- **Using the general purpose blades:**
  - AIX 5.3, 6.1
  - Linux on System x<sup>2</sup> (SOD)



<sup>1</sup> z/OS V1.9 support ends on Sept. 30, 2010. Lifecycle Extension for z/OS 1.9 is available Oct. 1, 2010. Note that z/OS 1.8 with the Lifecycle Extension for z/OS 1.8 and z/OS 1.7 with the Lifecycle Extension for z/OS 1.7 are also available with toleration support only.

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## ... and the Value Extends To Heterogeneous Platforms ...

### IBM zEnterprise BladeCenter Extension (zBX) Machine Type: 2458 – Model 002

- **Integrated IBM Certified Components driven by System z order**
  - Standard parts – TOR switch, BladeCenter Chassis, Power Distribution Units, Optional Acoustic Panels
- **System z support**
  - Problem reporting, hardware and firmware updates
- **Expanding operating system support for zEnterprise**
  - AIX, Linux on System x<sup>1</sup>
- **Simplified management**
  - Improved time to install and implement new applications
  - Central point of management for heterogeneous workloads
  - No change to applications



#### Optimizers

- IBM Smart Analytics Optimizer
- WebSphere® DataPower® appliance<sup>1</sup>

#### Select IBM Blades

- BladeCenter PS701 Express
- System x<sup>1</sup>

One to four – 42u racks – capacity for 112 blades
No System z software running in zBX – Passport Advantage software licensed to blades
No MIPS/MSU rating
Configured for high availability
Optional rear door heat exchanger



... managed by the  
**zEnterprise Unified Resource Manager**



## zBX ... Infrastructure to Support More Resources

- **zBX houses the multiplatform solutions key to the zEnterprise System.**
  - Optimizers that are dedicated to workloads.
    - IBM Smart Analytics Optimizer and WebSphere DataPower appliance<sup>1</sup>
    - Closed environments with hardware and software included in solution
    - Individualized tools for sizing and customizing – dependant on the optimizer
  - Select IBM POWER7 and System x<sup>1</sup> blades – running *any* application supported by the operating system installed on the blade – with no change.
  - Mix and match Optimizer and select general purpose POWER7 and System x blades in the same rack.
  - zBX is a System z machine type for integrated fulfillment, maintenance, and support
- **Secure network connection between zBX and z196 for data and support.**
  - Fast 10 Gb Ethernet connection to the data
  - Less latency – fewer ‘hops’ to get to the data
  - Private, isolated network - potential to eliminate requirement for encryption / firewalls
  - Traffic on user networks not affected.
- **Sharing of resources – up to eight z196 servers can attach to the zBX and have access to solutions**
- **Configuration, support, monitoring, management – all by Unified Resource Manager**

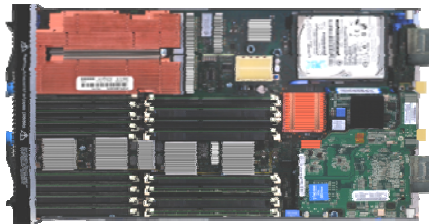


## IBM POWER7 and System x<sup>1</sup> Blades

*General purpose processors under one management umbrella*

### What is it?

*The zBX infrastructure can host select IBM POWER7 and System x blades. Each blade comes with an installed hypervisor that offers the possibility of running an application that spans z/OS, Linux on System z, AIX on POWER®, or Linux on System x (SOD) <sup>1</sup> but have it under a single management umbrella.*



### How is it different?

- **Complete management:** Advanced management brings operational control and cost benefits, improved security, workload management based on goals and policies.
- **Virtualized and Optimized:** Virtualization means fewer resources are required to meet peak demands with optimized interconnection.
- **Integrated:** Integration with System z brings heterogeneous resources together that can be managed as one.
- **Transparency:** Applications certified to run on AIX 5.3 or 6.1 will also be certified and run on the POWER7 blade. No changes to deployed guest images.
- **More applications:** Brings larger application portfolio to System z.

<sup>1</sup> All statements regarding IBM future direction and intent are subject to change or withdrawal without notice, and represents goals and objectives only.

## IBM Smart Analytics Optimizer

*Capitalizing on breakthrough technologies to accelerate business analytics*

### What is it?

*The IBM Smart Analytics Optimizer is a workload optimized, appliance-like, add-on, that enables the integration of business insights into operational processes to drive winning strategies. It accelerates select queries, with unprecedented response times.*



### How is it different?

- **Performance:** Unprecedented response times to enable 'train of thought' analyses frequently blocked by poor query performance.
- **Integration:** Connects to DB2® through deep integration providing transparency to all applications.
- **Self-managed workloads:** Queries are executed in the most efficient way.
- **Transparency:** Applications connected to DB2, are entirely unaware of IBM Smart Analytics Optimizer.
- **Simplified administration:** Appliance-like hands-free operations, eliminating many database tuning tasks.

***Faster insights for enabling new opportunities***

## WebSphere DataPower<sup>1</sup> Appliance in the zBX

*Purpose-built hardware for simplified deployment and hardened security*

### What is it?

*The IBM WebSphere DataPower appliance (SOD)<sup>1</sup> integrated in the zEnterprise System, can help simplify, govern, and enhance the security of XML and IT services by providing connectivity, gateway functions, data transformation, protocol bridging, and intelligent load distribution.*



### How is it different?

- **Security:** VLAN support provides enforced isolation of network traffic with secure private networks. And integration with RACF<sup>®</sup> security.
- **Improved support:** Monitoring of hardware with “call home” for current/expected problems and support by System z Service Support Representative.
- **System z packaging:** Increased quality with pre-testing of blade and zBX. Upgrade history available to ease growth. Guided placement of blades to optimize.
- **Operational controls:** Monitoring rolled into System z environment from single console. Time synchronization with System z. Consistent change management with Unified Resource Manager.

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## Management Stack

*Building an architectural construct of hardware, software, services*

### Service Management

- Visibility, Control and Automation for Applications, Transactions, Databases and Data Center Resources
- End-to End Workload Management and Service Level Objectives that Align IT Management with Business Goals
- Common Usage and Accounting for business accounting
- Dynamic/Centralized Management of Application Workloads based on Policies
- Business Resilience for multi-site recovery
- End-to-end Enterprise Security

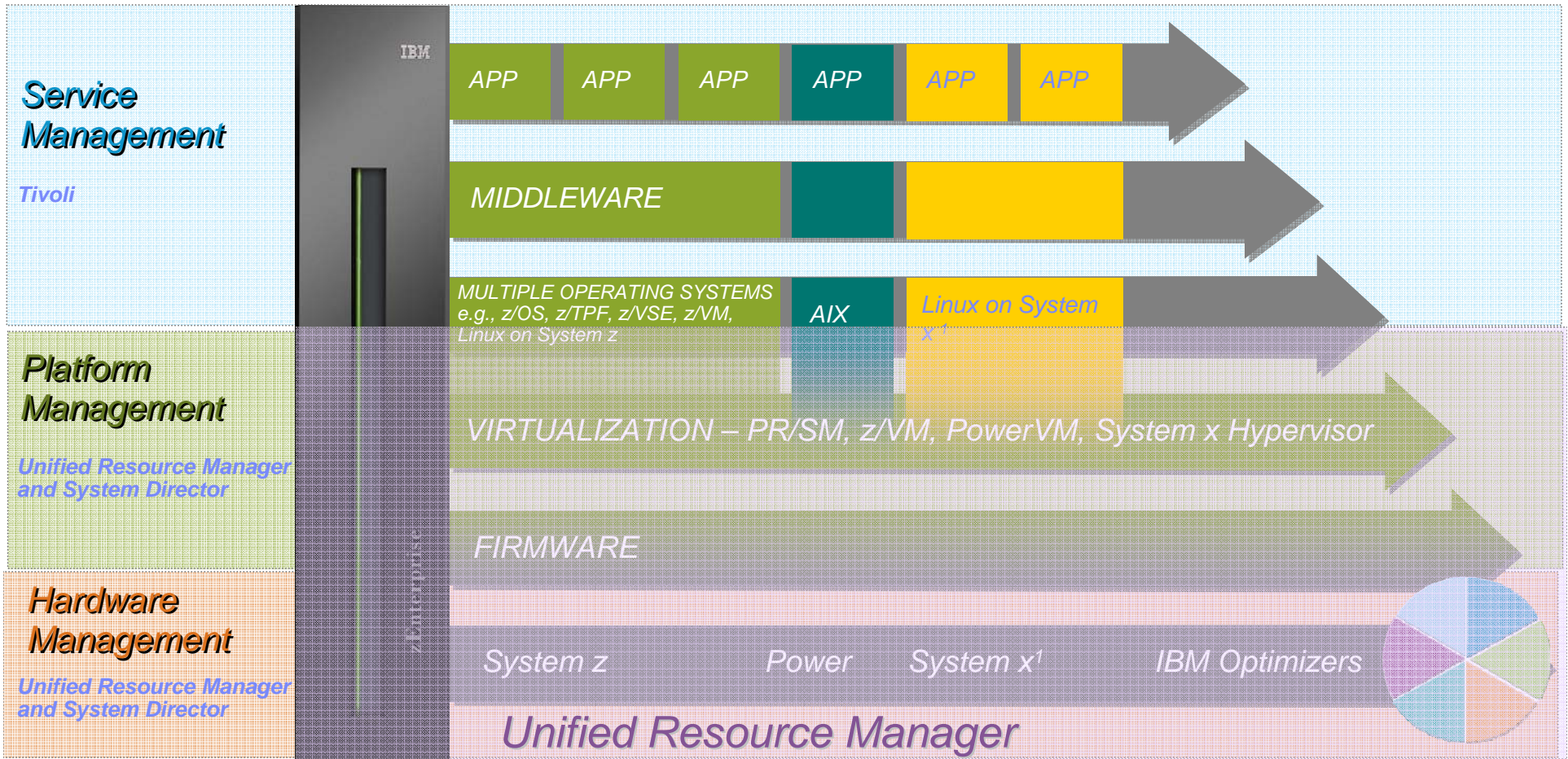
### Platform Management

### *Extending with* **Unified Resource Manager**

### Hardware Management

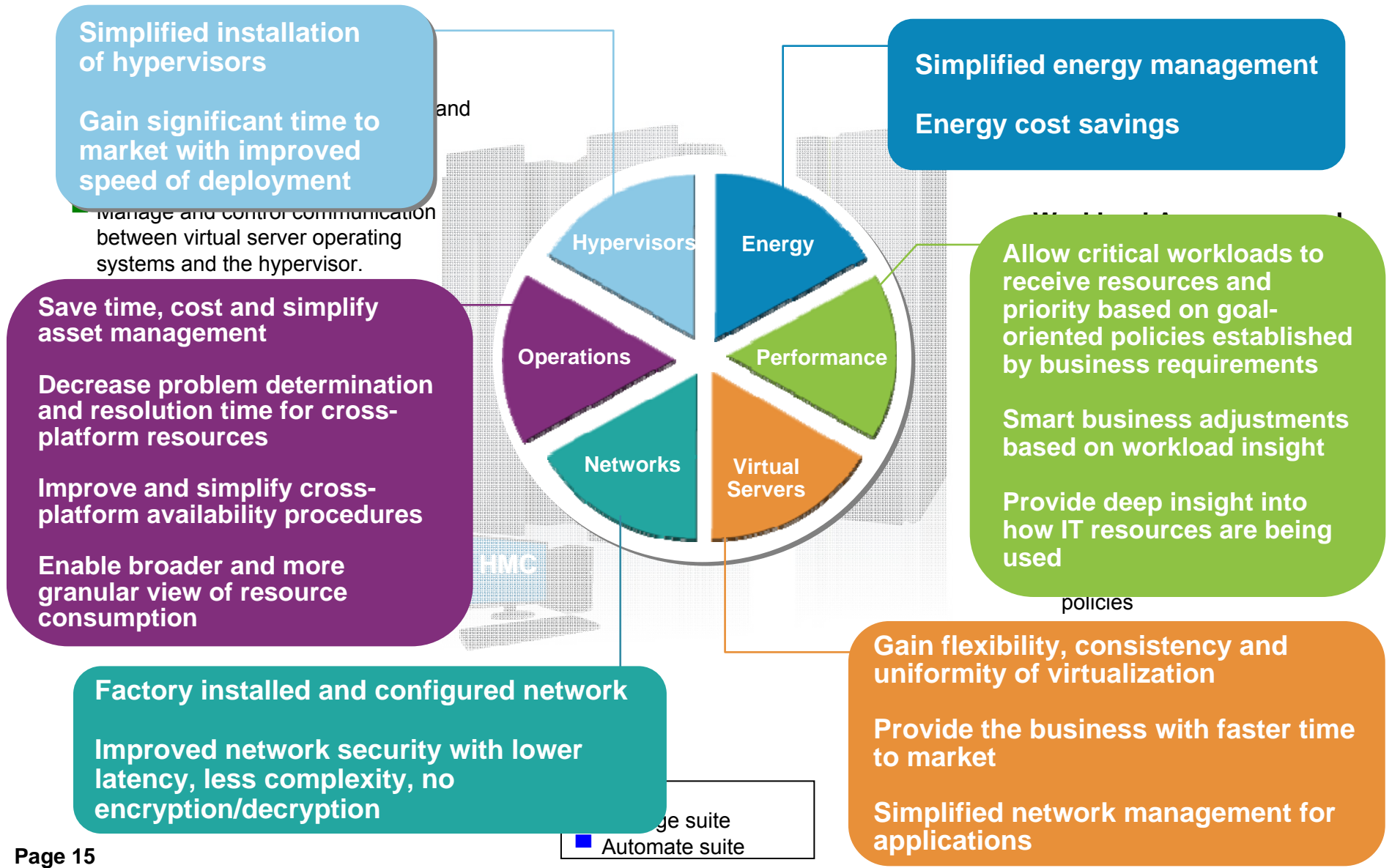
- Hypervisor management and creation of virtual networks
- Operational controls, service and support for hardware / firmware
- Network management of private and secure data and support networks
- Energy monitoring and management
- Workload awareness and platform performance management
- Virtualization management – single view of virtualization across the platform

# zEnterprise extends Service Management for improved governance



*Focused, collaborative innovation  
A “complete systems” approach*

# ... Value Made Possible By the Unified Resource Manager



# IBM® zEnterprise™ System

## Network Virtualization and Management Overview





## Agenda – IBM zEnterprise System Networking Overview

- ✓ zEnterprise Node Physical Infrastructure
- ✓ Communications within the Ensemble
- ✓ Network and OSA Types and Attributes
- ✓ External Network Access
- ✓ Network Virtualization Management
- ✓ Provisioning Virtual Networks
- ✓ Network Access Control and Security

### Notices:

1. All statements regarding IBM future direction and intent are subject to change or withdrawal without notice, and represents goals and objectives only.
2. The zEnterprise internal networks are provided with redundant hardware – redundancy is NOT shown in this presentation



## zEnterprise Networking Value Points

### Network Simplification

- ✓ Single physical network and zBX “package” (physical network integration)
- ✓ Central point of Management (zManager via the HMC/SE)

### Secure communications

- ✓ Physical security (internal / dedicated network equipment)
- ✓ Logical security (controlled access)
- ✓ Network Virtualization and Isolation

### High Availability

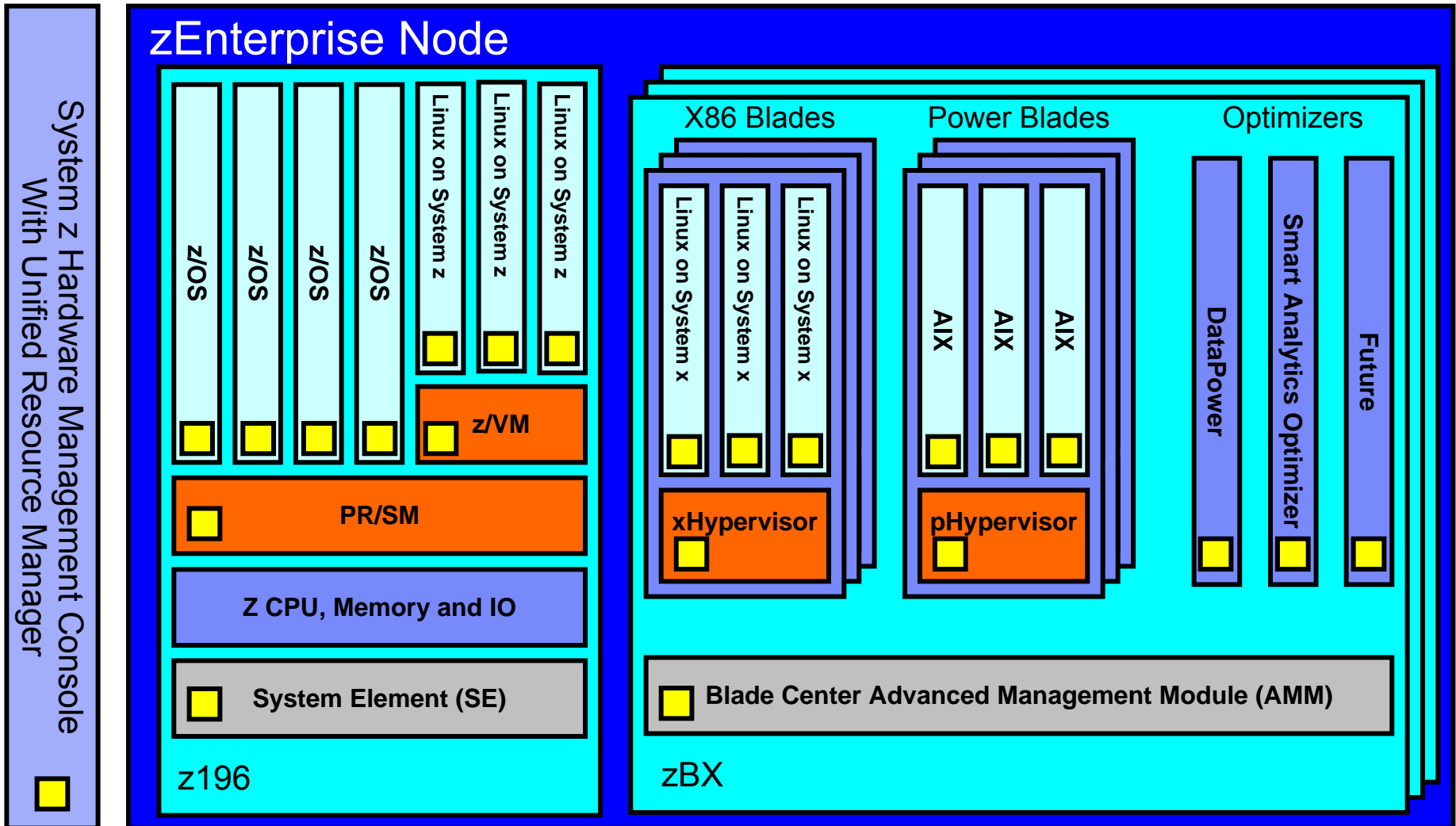
- ✓ Redundant Network Hardware
- ✓ Logical failover

### Unique System z QoS

- ✓ Isolated / dedicated equipment
- ✓ Special purpose dedicated data network & OSA-Express (no encryption required)

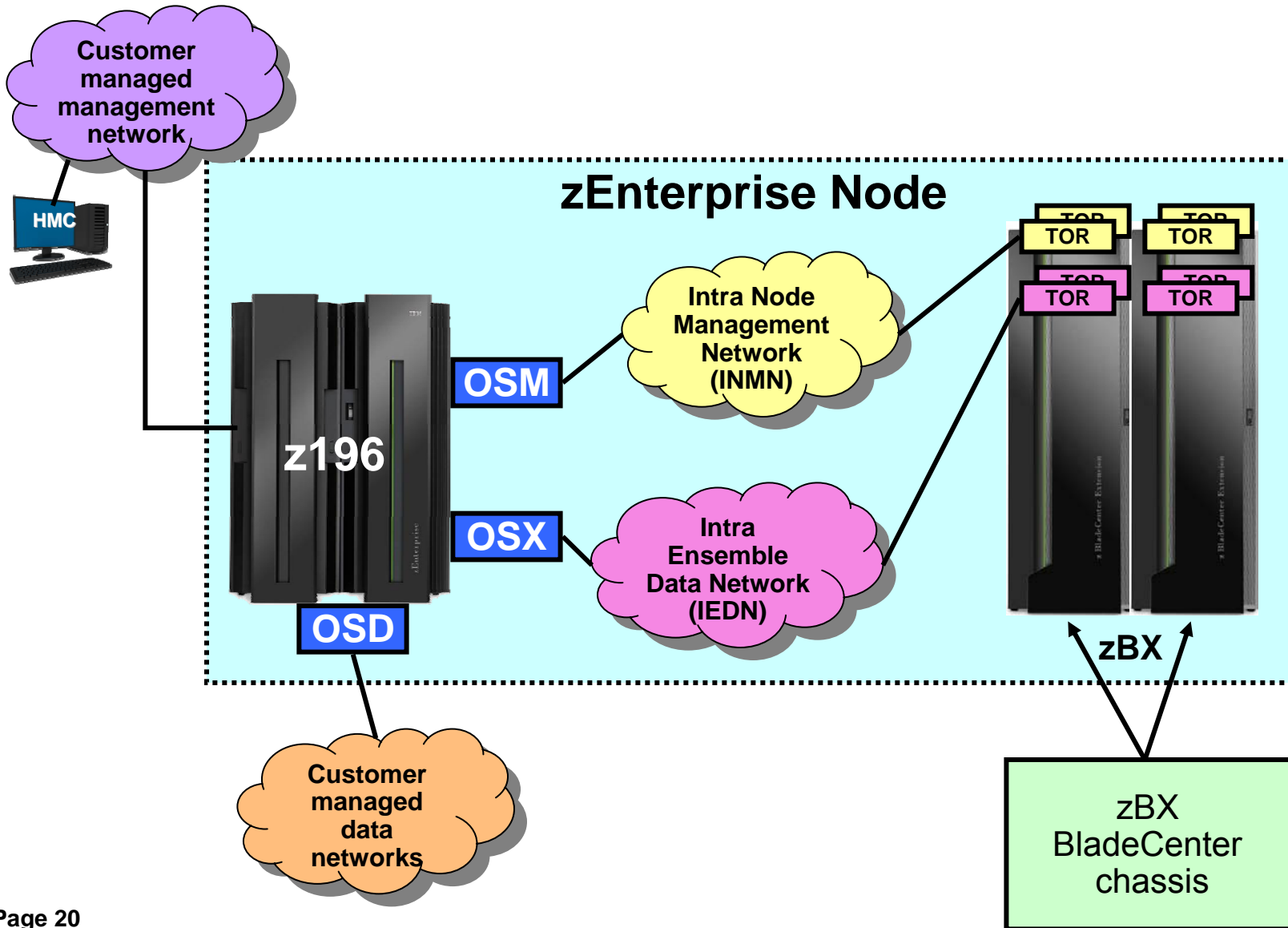


# IBM zEnterprise System Overview



Connecting the pieces with zManager (aka. Unified Resource Manager)!

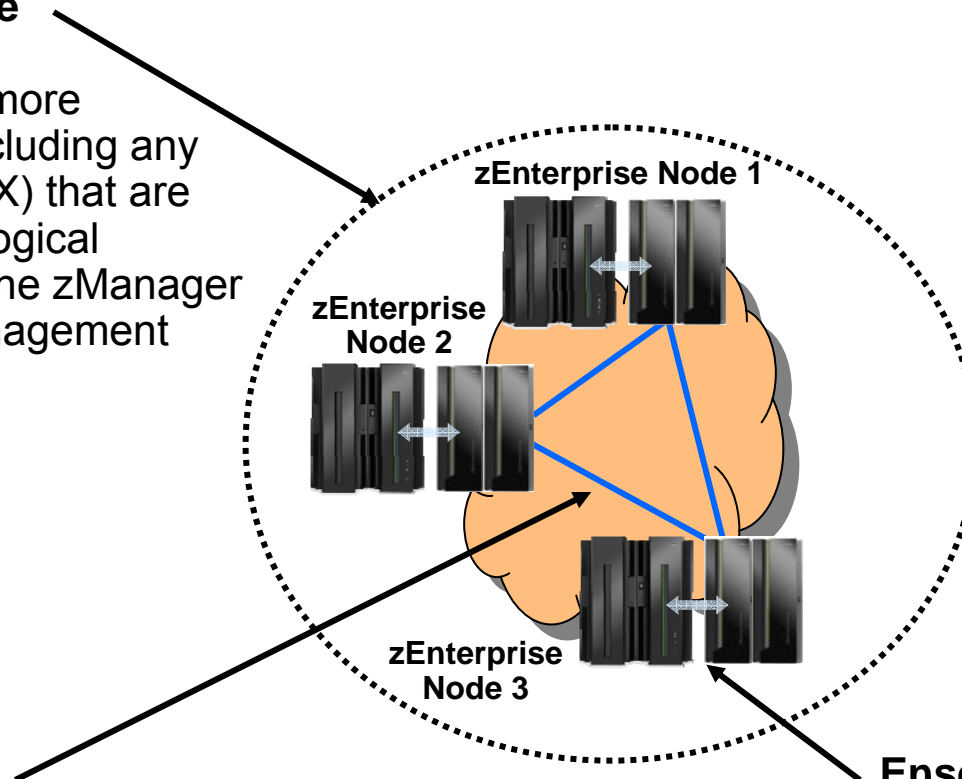
# IBM zEnterprise node with internal networks



# IBM zEnterprise Node with Internal Networks

## zEnterprise Ensemble

A collection of one or more zEnterprise Nodes (including any optionally attached zBX) that are managed as a single logical virtualized system by the zManager using a Hardware Management Console (HMC).

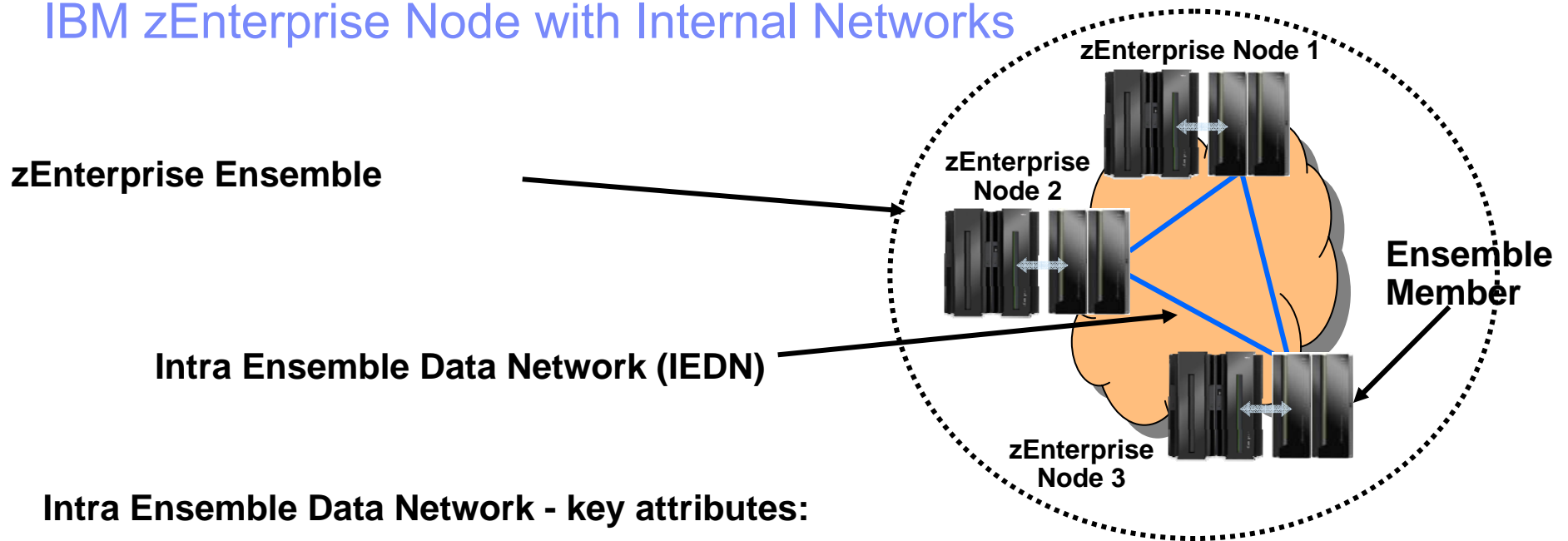


## Intra Ensemble Data Network (IEDN)

## Ensemble Member

A zEnterprise node that has been added to an ensemble using the HMC.

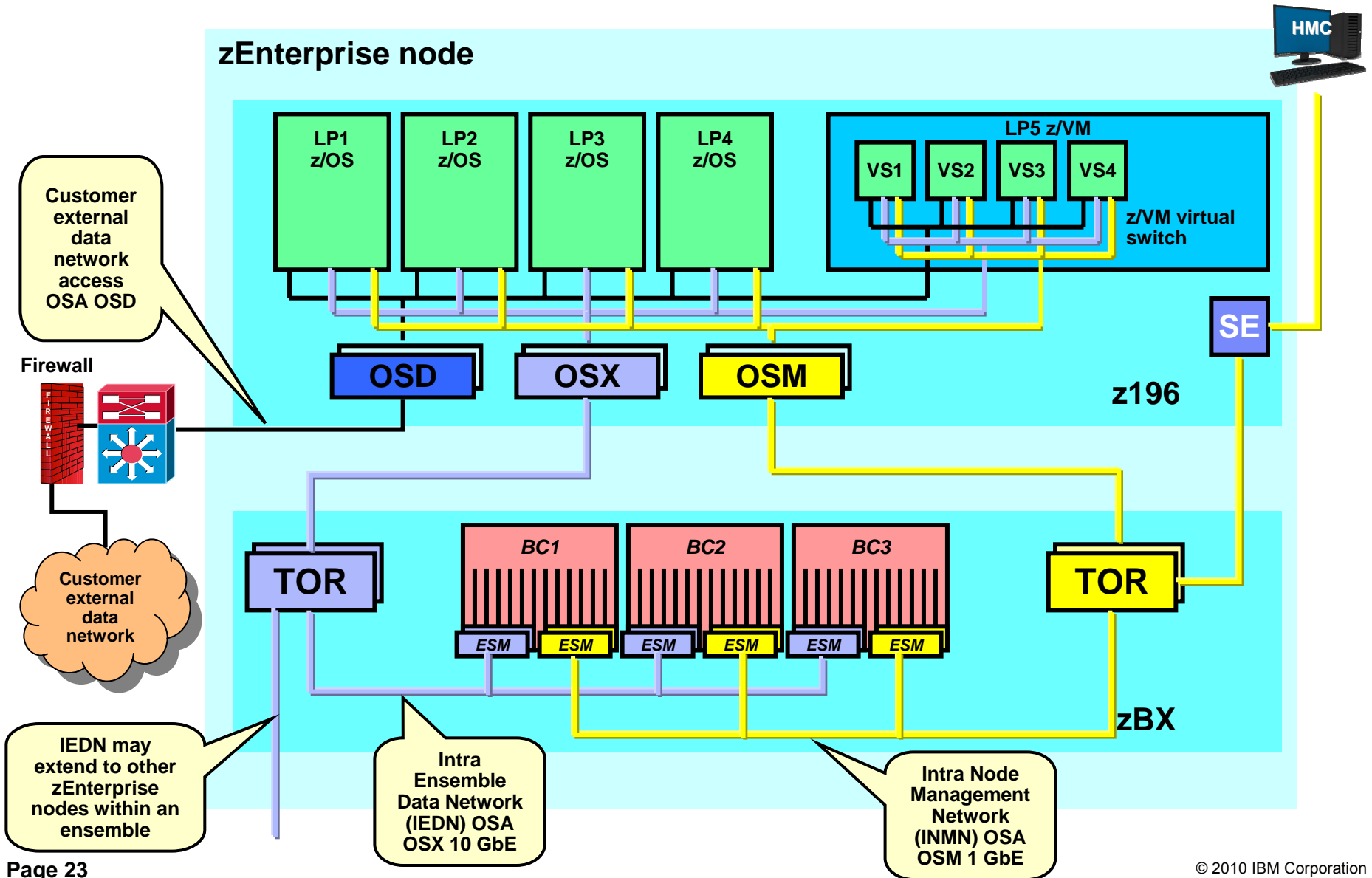
## IBM zEnterprise Node with Internal Networks



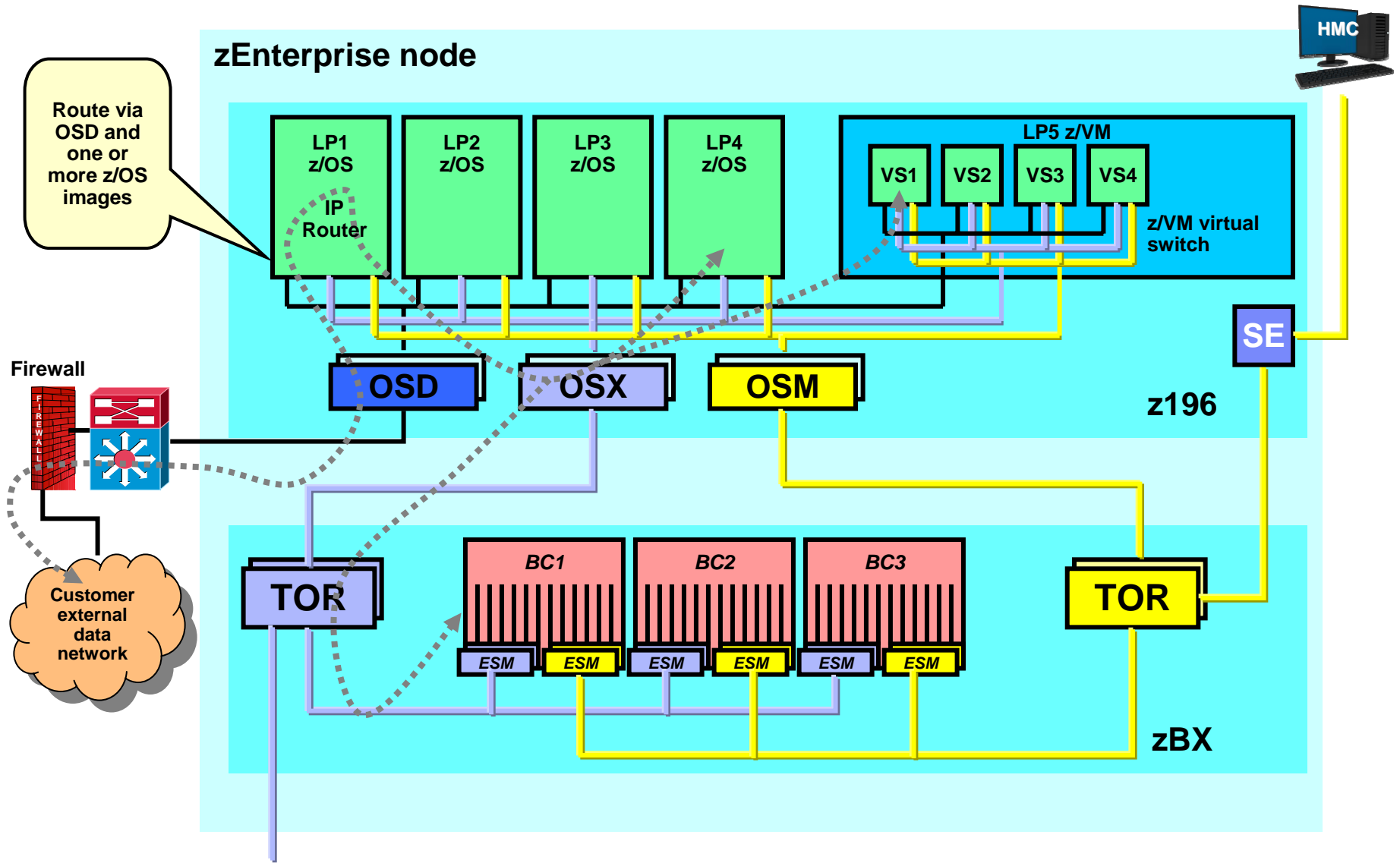
### Intra Ensemble Data Network - key attributes:

1. Single dedicated physical / flat layer 2 10GbE network
2. Comprised of IBM zEnterprise (redundant) equipment (no external / customer hardware)
3. Can span nodes (i.e. can be shared by all co-located nodes within the Ensemble - 10km limit)
4. No layer 3 IP Routing required to communicate within the Ensemble
5. IP addresses (IPv4 or IPv6) are customer controlled (provisioned)
6. MAC addresses (prefixes) are provisioned / coordinated by zManager (HMC)
7. Access to the network is controlled by the zManager (HMC) via SE via OSX, hypervisors and physical switches
8. Virtual servers can be isolated into multiple groups on the physical network by defining multiple virtual networks (multiple VLANs) based on workloads and other isolation requirements

# IBM zEnterprise – OSA and Network Types

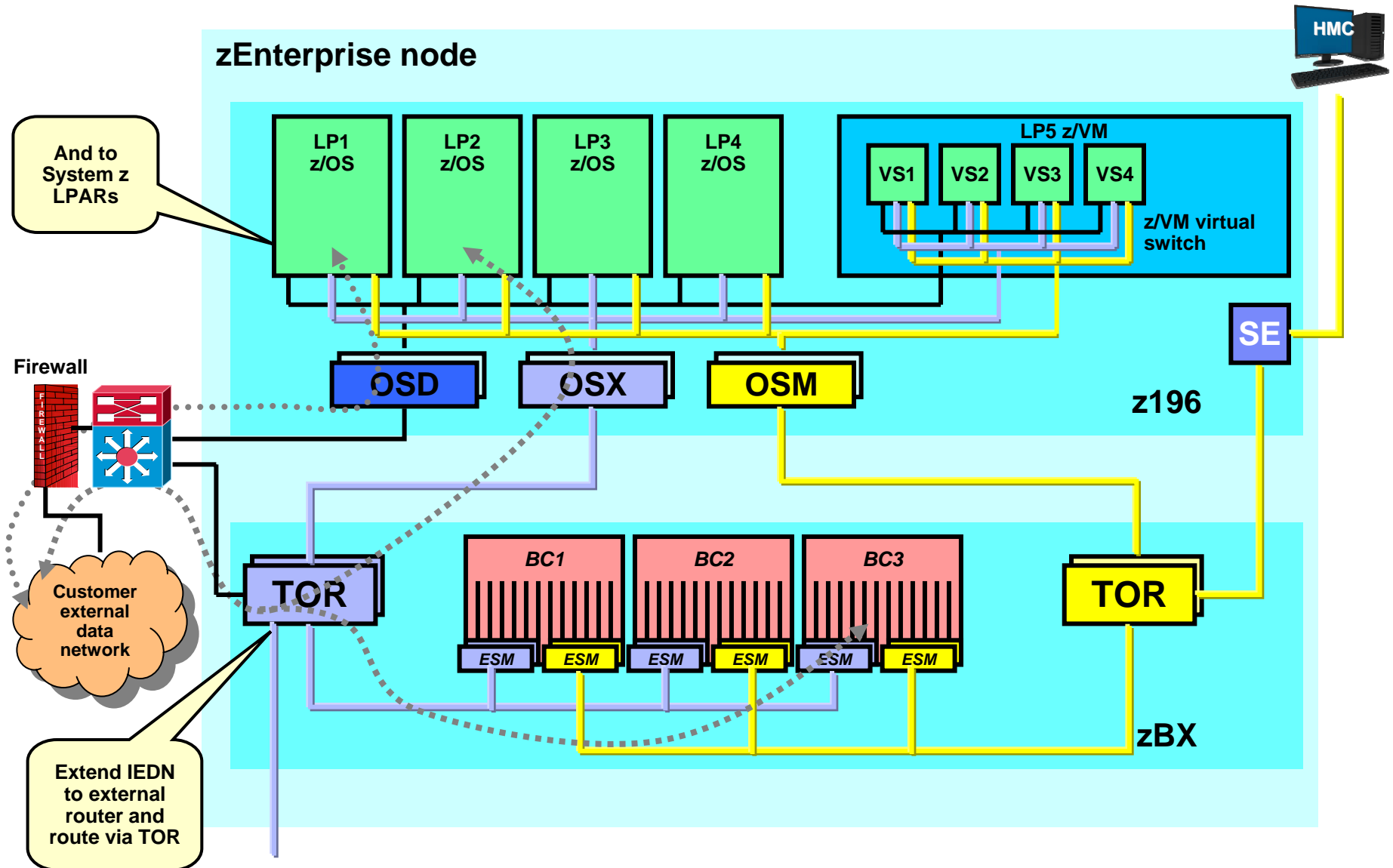


# External Network Access – Option 1 – System z (LP) IP Router





# External Network Access – Option 2 – External IP Router

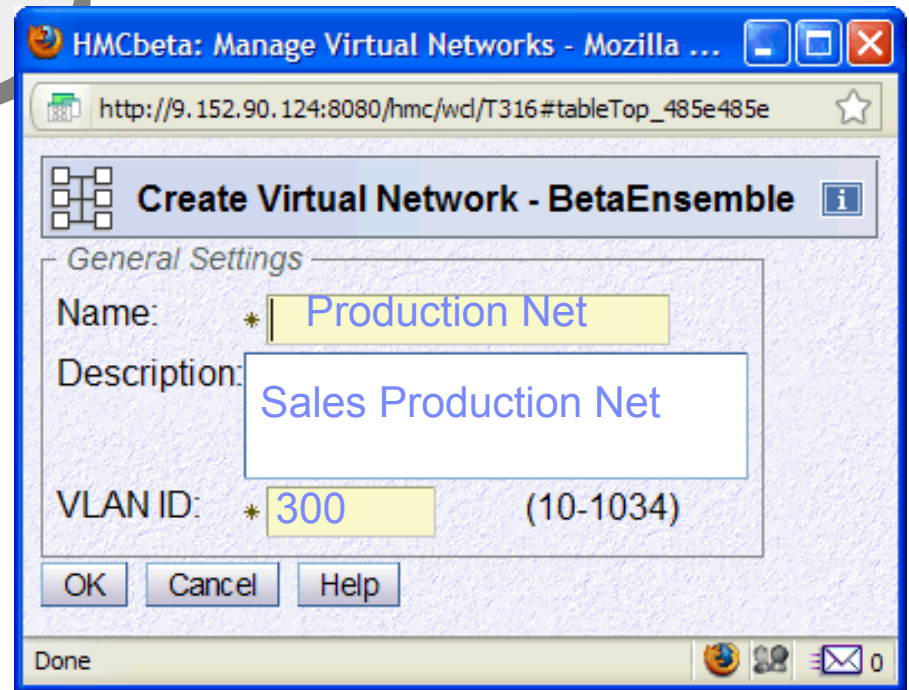


## Virtual Network Concepts – Creating Virtual Networks

Step 1. Create / Define a Virtual Network

Network Name =  
Production Net

VLAN ID = 300



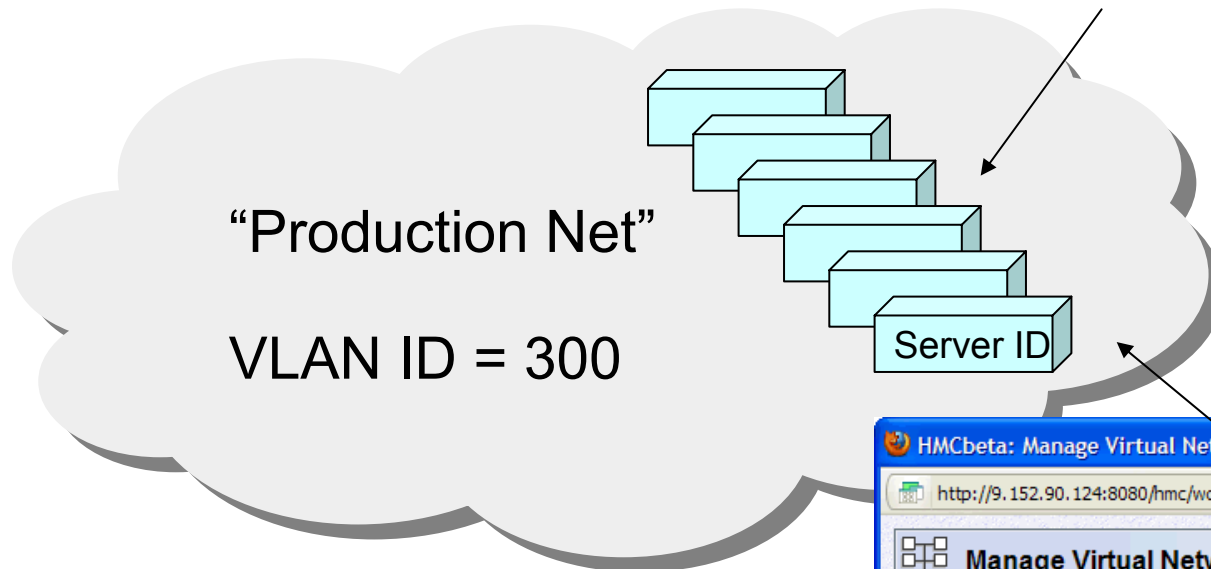
... from the  
zManager (HMC)



## Virtual Network Concepts – Adding Virtual Servers

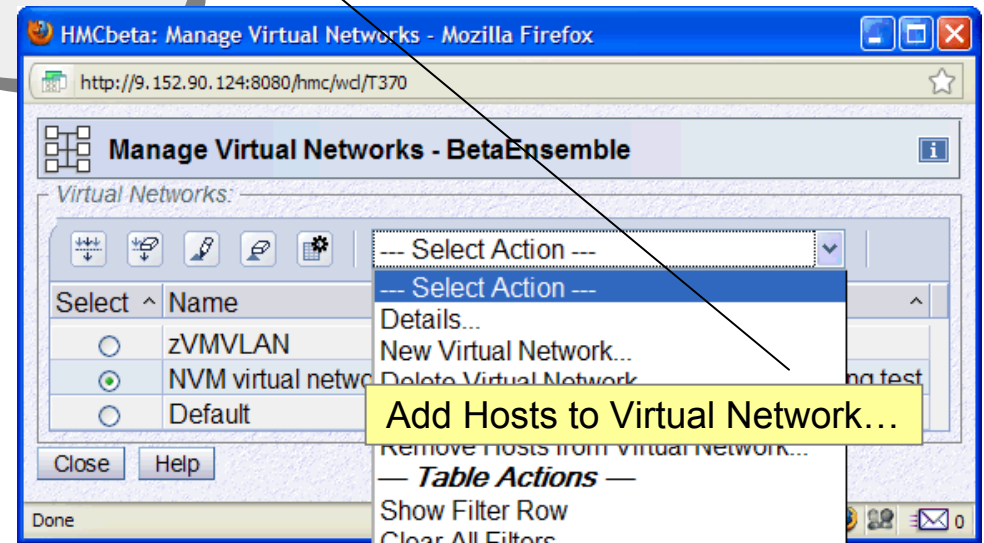
... once you have a Virtual Network...

Step 2. ...as necessary ...add (associate / authorize) Virtual Servers to the Virtual Network

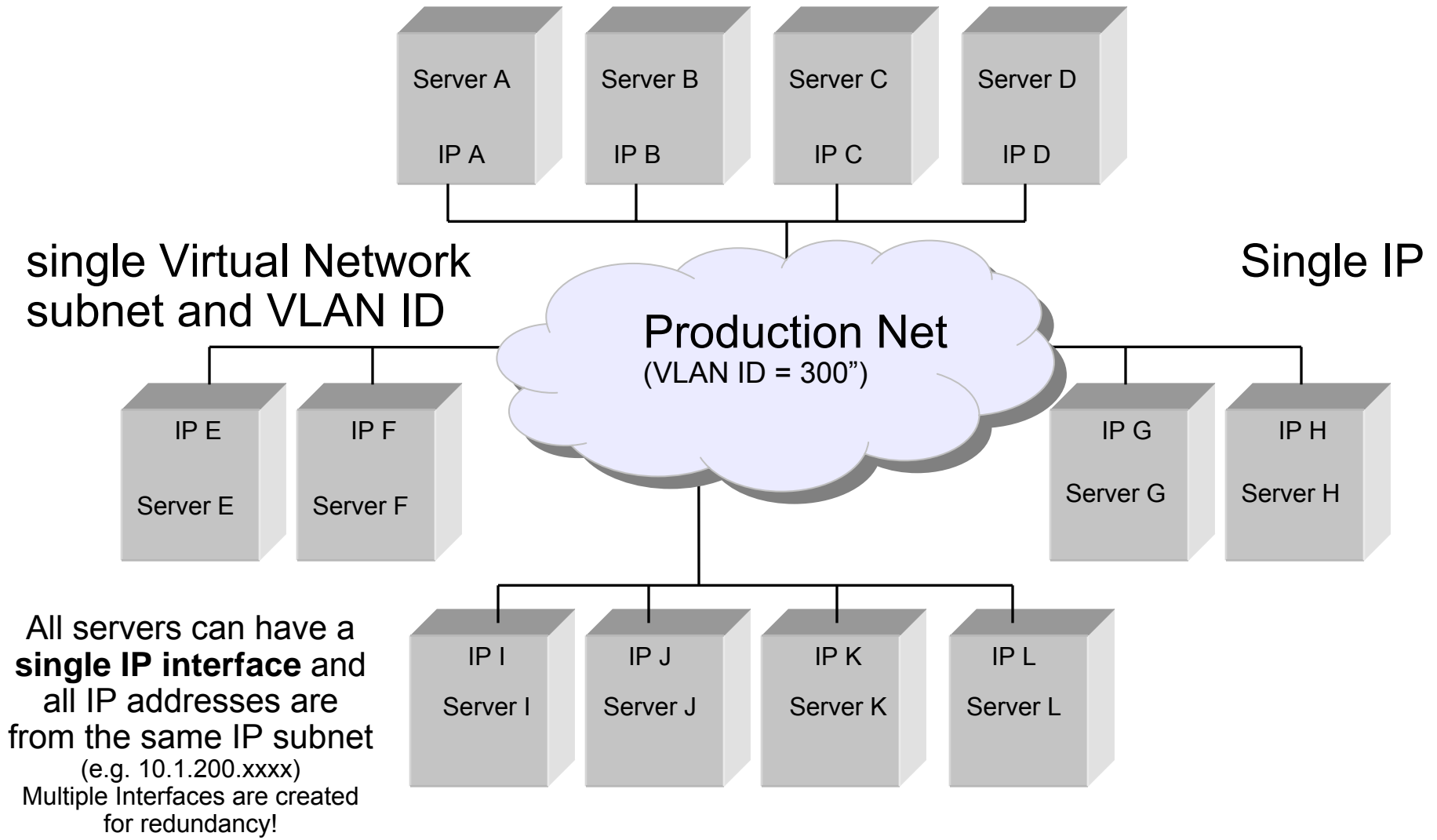


**Virtual Networks consist of two key properties:**

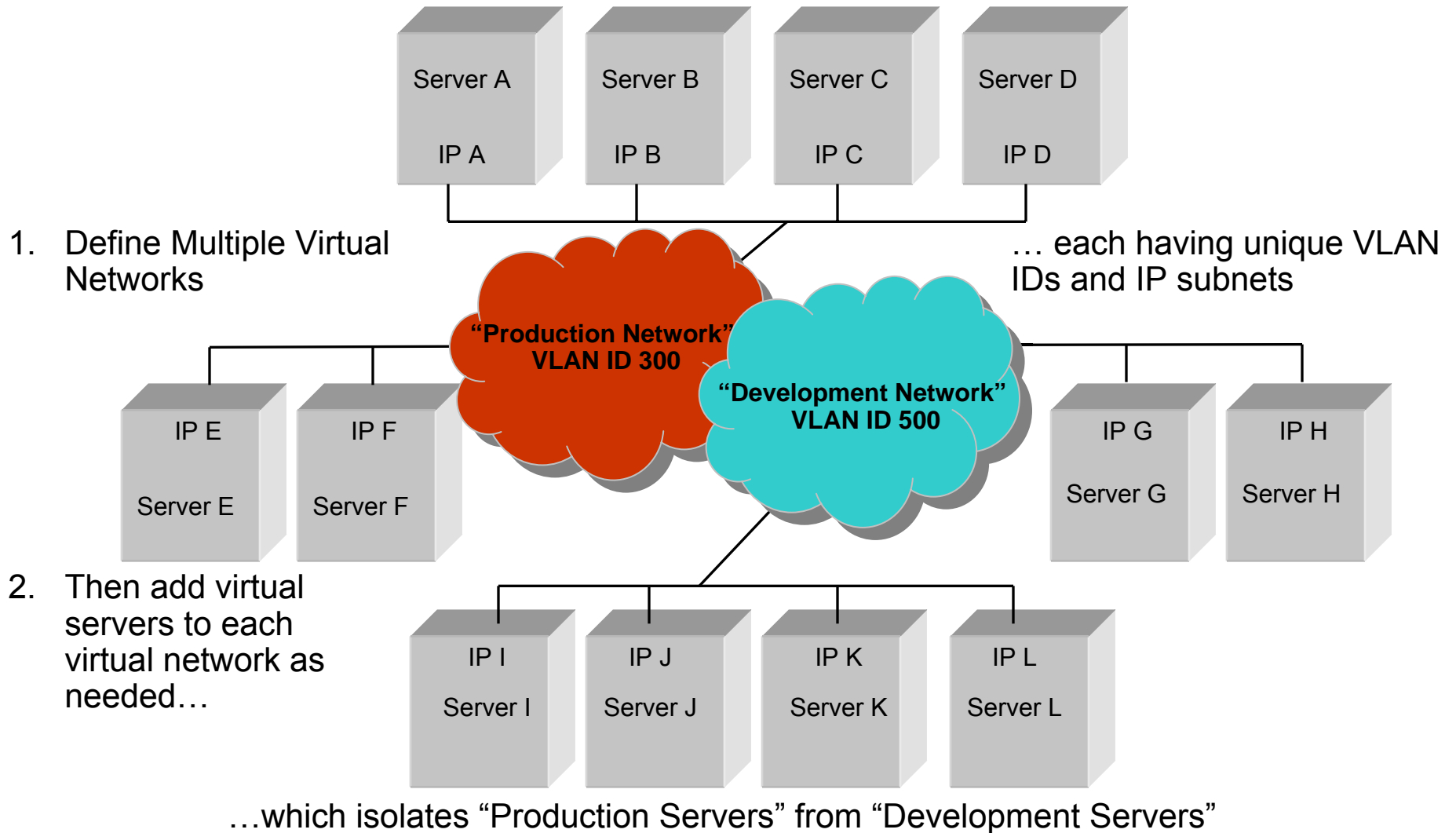
1. **VLAN ID (IP subnet)**
2. **List of Authorized Servers**



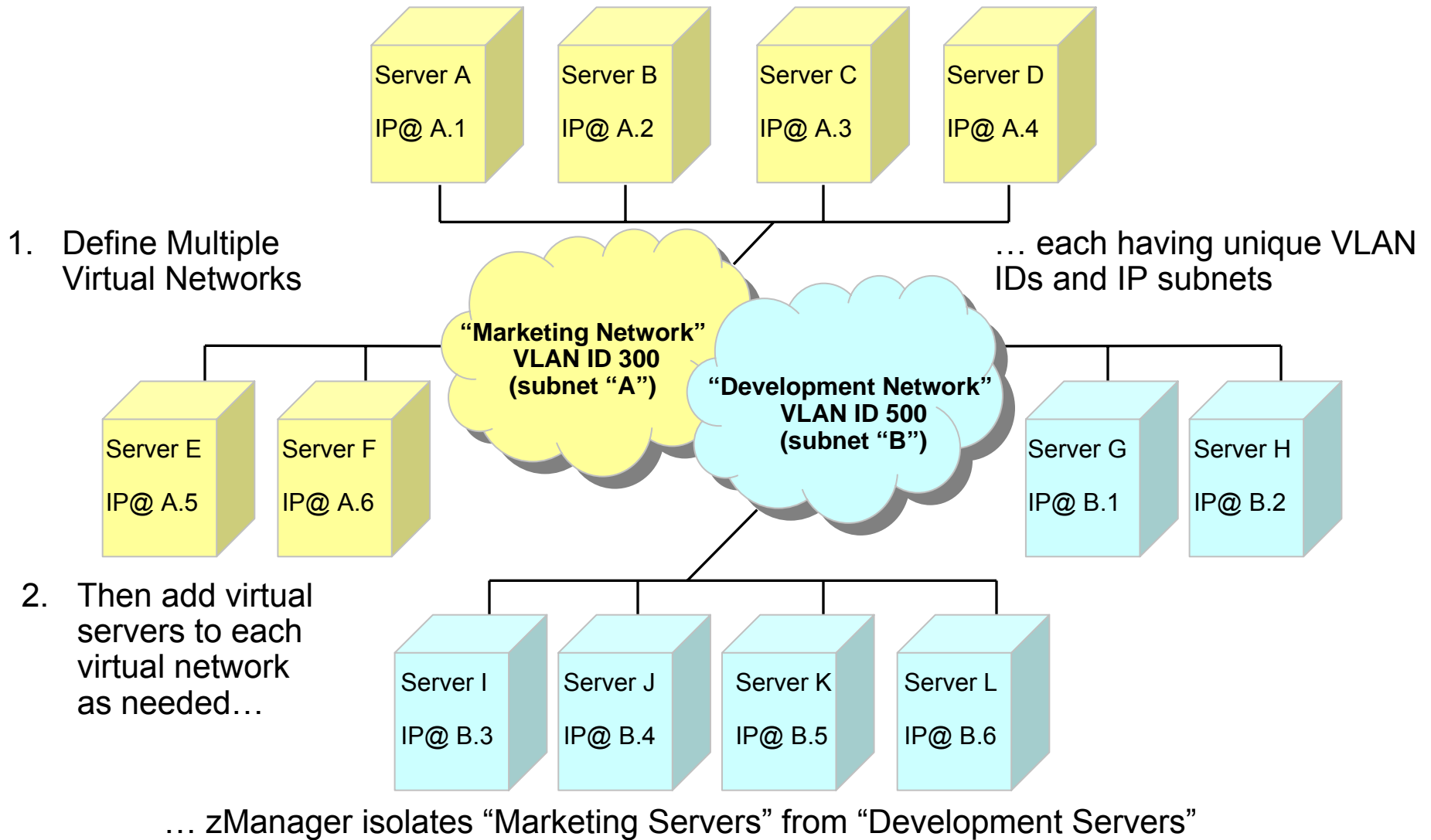
## Deploying a Virtual Network – Example 1



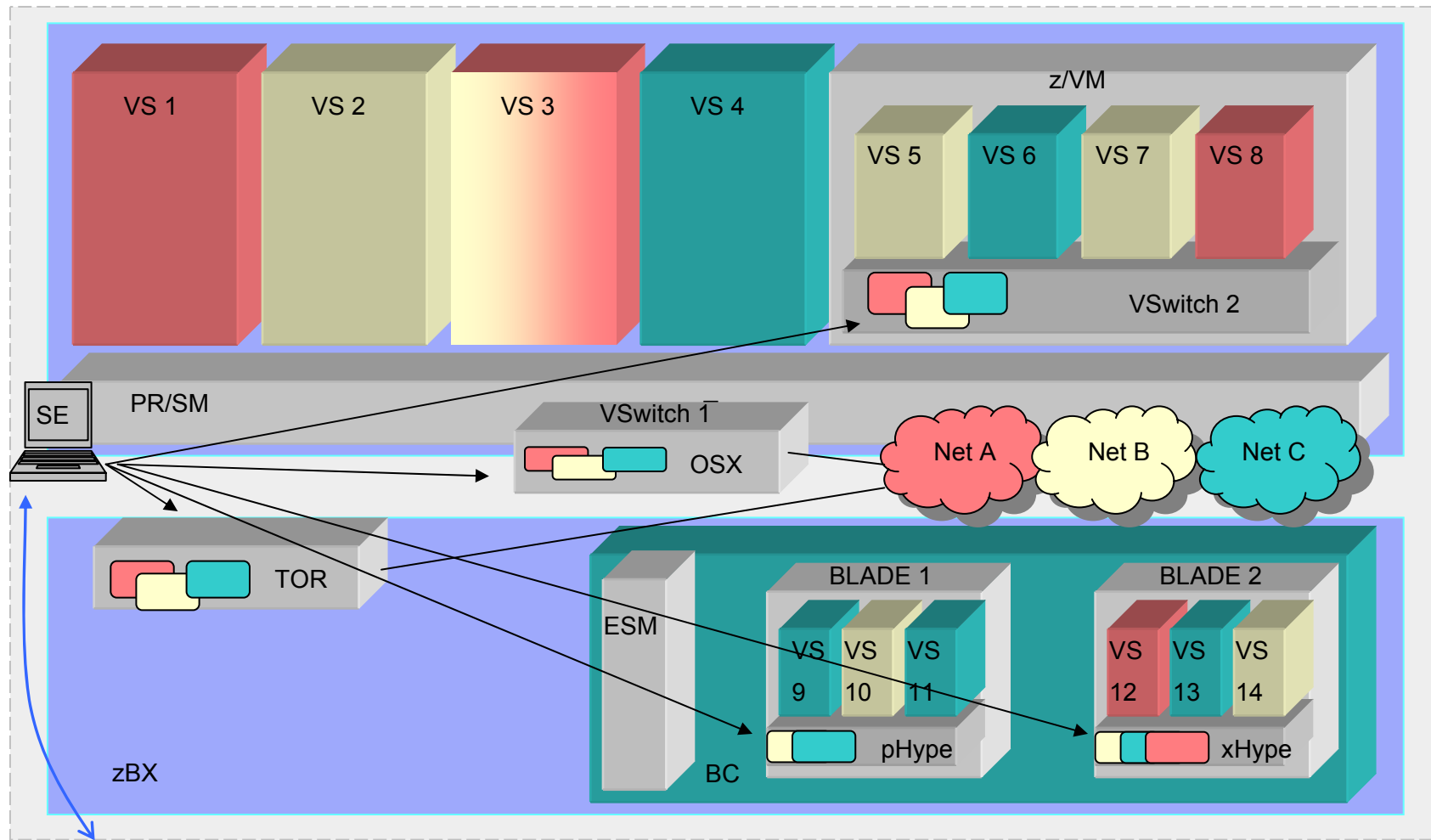
## Deploying Multiple Virtual Networks – Example 2 - Isolation



## Deploying Multiple Virtual Networks – Isolation



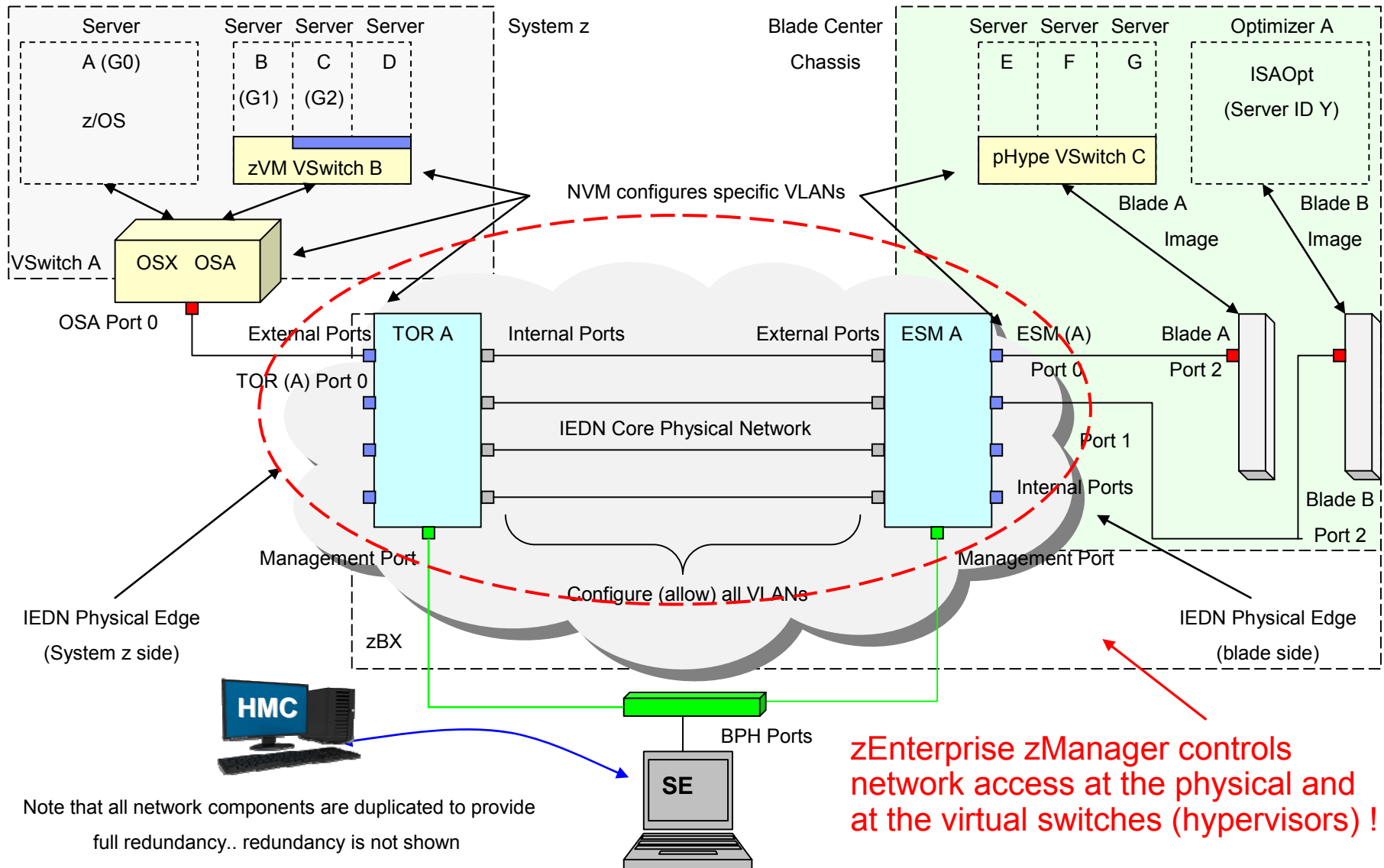
## zEnterprise Virtualization and Network Access Control



zManager pushes virtual network access control information to the node and the SE propagates to control points (OSX and Hypervisors)



# Putting It All Together...with secure access control !

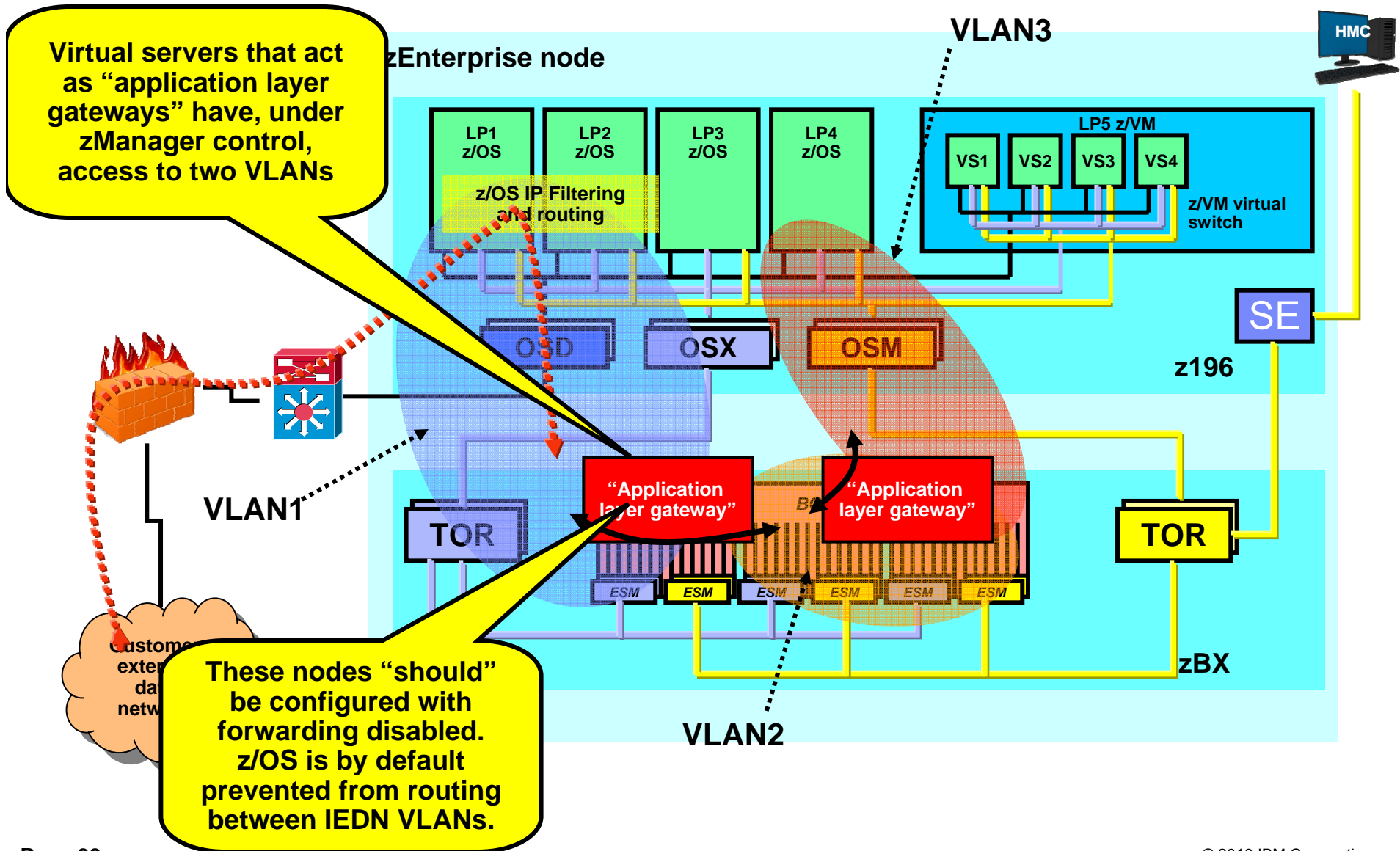


Note that all network components are duplicated to provide full redundancy.. redundancy is not shown

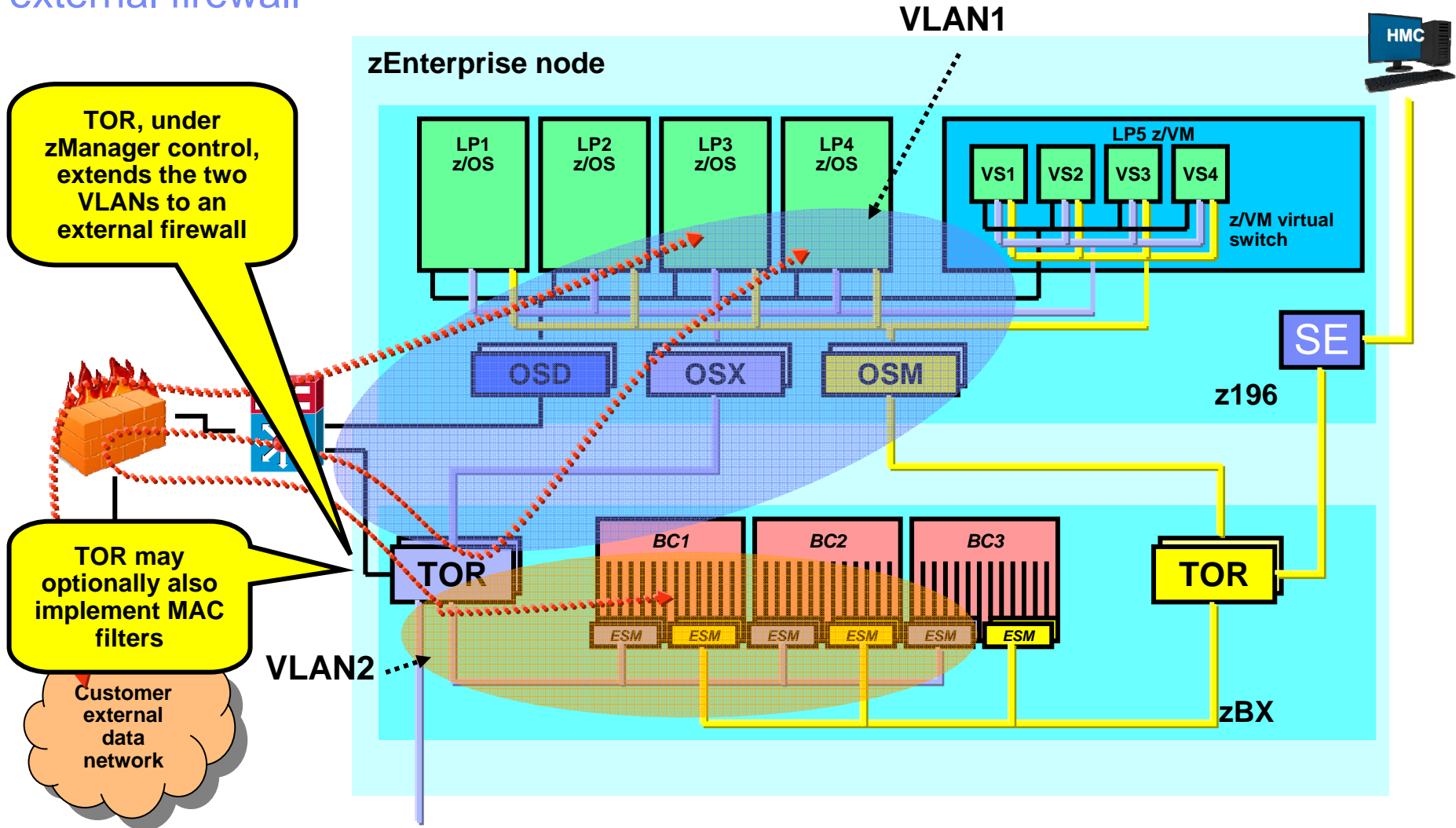
**zEnterprise zManager controls network access at the physical and at the virtual switches (hypervisors) !**



## Use of multiple VLANs on the IEDN – “application layer gateways” between VLANs



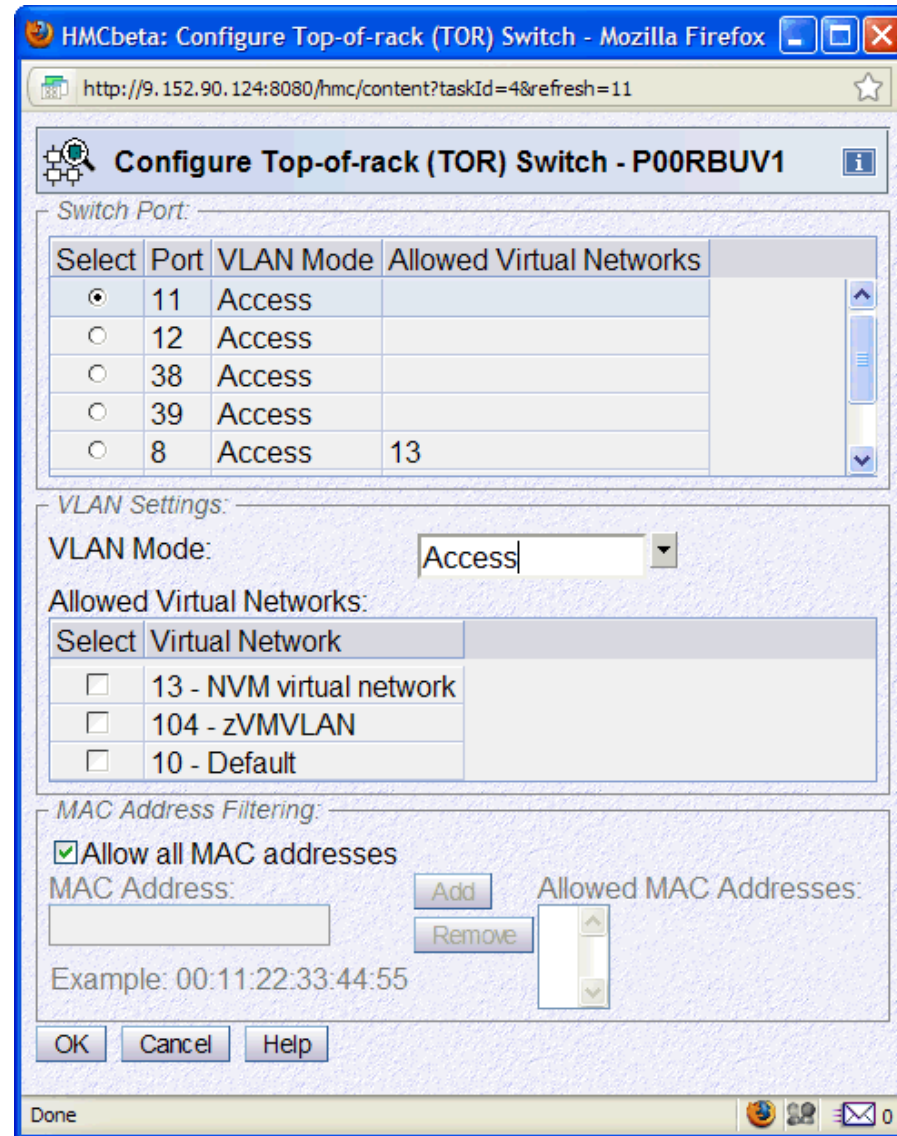
# Use of multiple VLANs on the IEDN – Routing between VLANs using an external firewall



# Configuring TOR - External Network Access

Two Use Cases:

- 1. z10 Access
- 2. External IP Router



## Summary - Exploiting the intraensemble data network

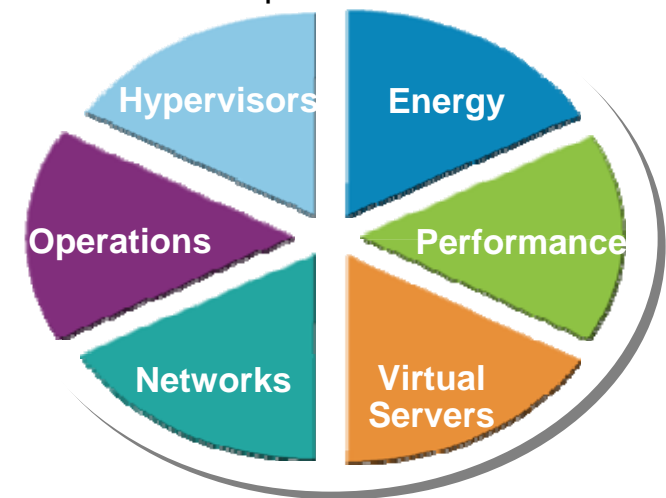
Once all hardware / physical installation and System z HCD configuration tasks are complete... then you are ready to exploit the IEDN:

Key concepts / reminders:

1. All network traffic on the IEDN must use an “authorized” VLAN ID!
2. The VLAN ID maps to a corresponding Virtual Network
3. All host images (Operating Systems) on all platforms within the Ensemble are represented as a Virtual Server

Key zManager network related configuration tasks:

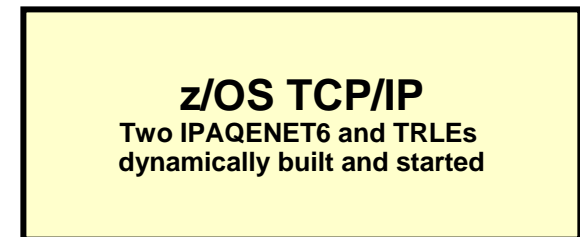
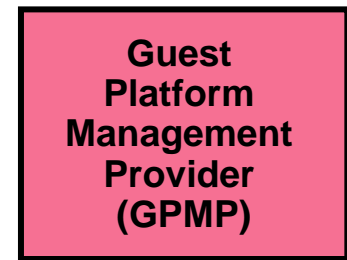
1. Virtual Network Configuration (at the HMC) consist of:
  - defining a virtual network (VLAN ID)
2. Virtual Server configuration:
  - Define each virtual server
  - Associate each virtual server with the proper Virtual network
3. Virtual Switch configuration (if applicable – N/A to native LPs)



Finally - Operating System network configuration tasks (IP address, VLAN ID, etc.) remain within the OS – the OS VLAN ID must match the HMC VLAN ID configuration

## z/OS Communications Server and OSM connectivity

- z/OS LPAR must participate in the ensemble
  - New VTAM start option: ENSEMBLE=YES
    - Required for both OSM and OSX connectivity
- LPAR must be IPv6-enabled for OSM connectivity
- Two IPAQENET6 interface definitions are dynamically generated and started
  - If OSM CHPIDs are defined to the z/OS image, the two CHPIDs with the lowest device numbers are assigned to these interfaces
- TRLEs dynamically generated if connectivity allowed and CHPIDs found
- Only port 0 supported
- IPv6 link-local address only
- Uses VLAN in access mode
  - Switch handles VLAN tagging, stack unaware
- Not reported to OMPROUTE
- Cannot add static or dynamic routes
- Supports stop, start, packet trace, NTA
- Only applications permitted to EZB.OSM.sysname.tcpname can communicate over OSM interfaces
  - The GPMP is the only application that needs to



## z/OS Communications Server and OSX connectivity

- Configure with INTERFACE statement
  - IPAQENET and IPAQENET6
- Either specify CHPID
  - Dynamically created TRLE similar to HiperSockets
- Or configure TRLE and point to it
  - Useful in VM guest LAN environment where CHPID is unpredictable
- Always uses VLAN in trunk mode
  - VLANID required and must be authorized at HMC
    - If not authorized, OSA activation fails
- Prevents IP forwarding from OSX ⇒ OSX
  - Sysplex distributor forwarding is allowed when using VIPAROUTE
- Supports stop, start, packet trace, NTA
- To prevent external traffic from being routed to the OSX VLAN
  - Define OSX as INTERFACE or IPV6\_INTERFACE
  - Do not enable IMPORT\_DIRECT\_ROUTES function
  - Alternatively, do not define the OSX interfaces to OMPROUTE and tell OMPROUTE to ignore undefined interfaces
- To allow external traffic to be routed to the OSX VLAN
  - Define OSX as OSPF\_INTERFACE or IPV6\_ISPF\_INTERFACE
  - Configure a non-0 value for ROUTER\_PRIORITY

**Normal z/OS Applications and Subsystems (CICS, IMS, DB2, MQ, WAS, etc.)**

**z/OS TCP/IP**  
Define IPAQENET or IPAQENET6 Interfaces with VLAN ID that matches HMC definitions

**OSX**



**OSX**

# Questions? - Thank You !



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